# APPENDIX H
# UPLAND SEDIMENT ANALYSIS

Prepared by Lolo National Forest

## Introduction

Sediment analysis was based on several different modeling tools. A spatial (GIS) model was used to calculate relative sediment production at the watershed scale, including natural sediment, sediment from roads, and sediment from timber harvest. Two site-specific models were used to determine sediment production from road segments and delivery to streams at specific delivery points (stream crossings) although the road components of this analysis are not used for the TMDL because the road analysis component accuracy was questionable.

It should be noted that models simplify extremely complex physical systems and are developed from a limited database. Although specific quantitative values for sediment are generated from this model, it is important to note that the results are used as a tool in the interpretation of how real systems may respond. Therefore, the models' use is realistically limited to providing a means of comparison, not an absolute measure against verifiable standards.

## Methods

***LoloSED***

The LoloSED computer model was used to analyze sediment production at the watershed scale including the HUC 6 tributary watersheds to the St. Regis River and the St. Regis HUC 5. LoloSED was adapted from the WATSED model. WATSED is a sediment production model developed by USDA Forest Service Region One and others (USDA, 1991). LoloSED is a spatially based, GIS implementation of WATSED, and includes coefficients specific to resources on the Lolo National Forest. LoloSED uses GIS layers for soil and landform (LSI), topography (DEM), hydrology (streams), vegetation (TSMRS stands), transportation (roads), precipitation (average annual), and project specific layers.

The Lolo National Forest's Land System Inventory (LSI) provides a natural sediment production coefficient for every land unit. Land units in the LSI, also known as LSI units or LSI's, were delineated based on soil, landform, and habitat type (USDA, 1988).

Natural sediment production from National Forest land in the St. Regis watershed was calculated by first overlaying the HUC 6 watersheds layer for the St. Regis with the LSI layer. A DEM (digital elevation model) was used to determine the average side slope and topographic position for each LSI unit in the St. Regis watershed. Hillslope and topographic position determine the sediment delivery ratio for each unit. The natural sediment production coefficients and delivery ratios were multiplied together to get a sediment yield value for each HUC 6 and by specific areas using GIS (**Table H-1 and Figure H-1**).

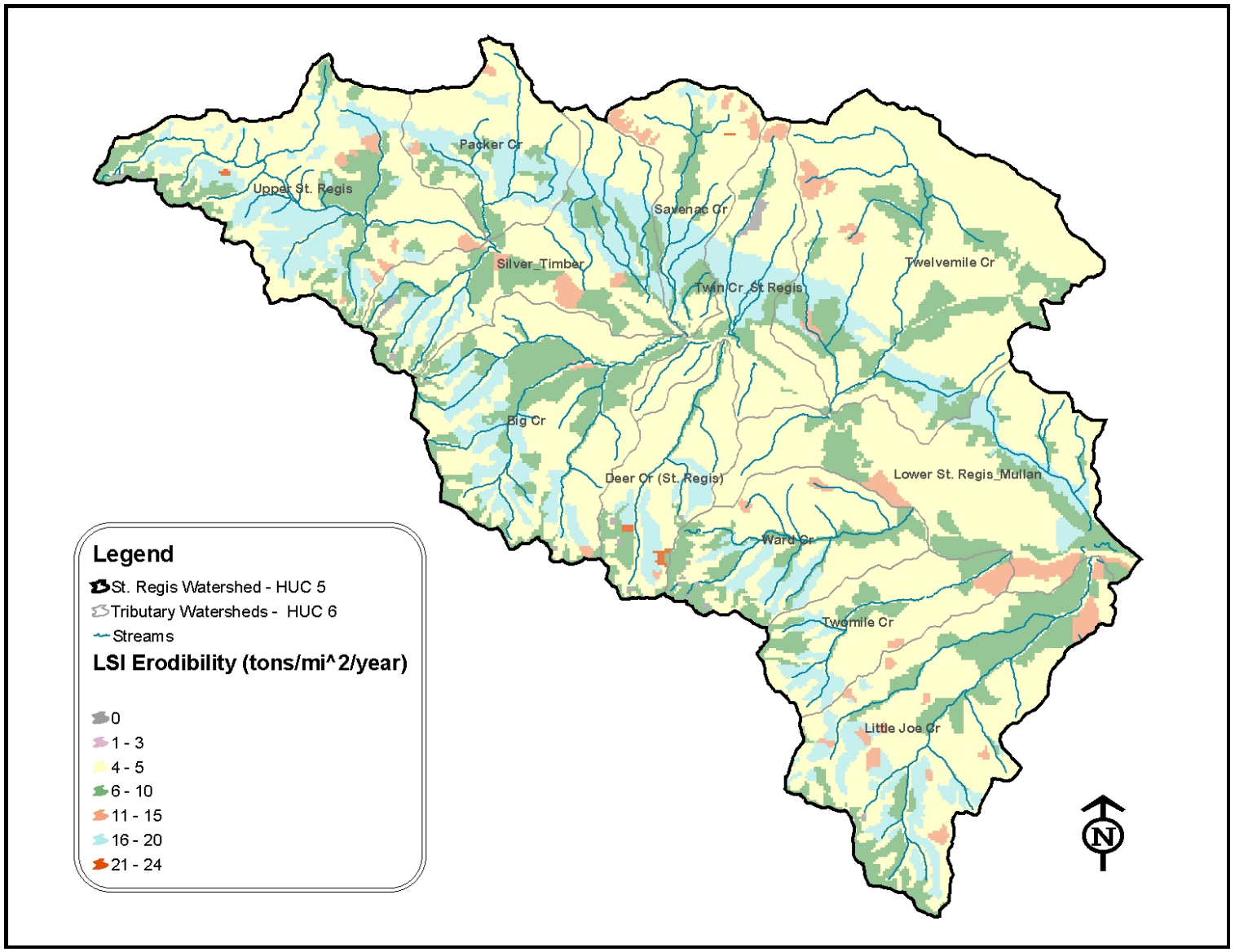


**Figure H-1. Land System Inventory units classified by relative risk of sediment production**

In addition to natural sediment production and delivery, sediment from roads and harvest activity was also analyzed (See also Harvest History Analysis write-up). For sediment production from roads, coefficients for closure level and natural revegetation, presence or absence of BMPs, and time since construction or re-construction were applied to road sediment production base rates. Base rates of road sediment production were calculated using road width, topography, and LSI. As for natural sediment production, delivery ratio coefficients were applied based on topographic position of each road segment. Similarly, for sediment production from timber harvest areas, production coefficients for the logging system used (tractor, skyline, or helicopter) were applied to the natural sediment production values.

## Results

***LoloSED modeled natural sediment***

Natural sediment production based on average annual precipitation was calculated for each HUC 6 tributary to the St. Regis River. These results were then summarized for the St. Regis HUC 5 (**Table H-1**). LoloSED modeled annual, natural sediment production for the St. Regis HUC 5 is approximately 2400 tons/year (**Figure H-2**). HUC 6 sediment production normalized by area shows Silver-Timber to be most erosive at 7.72 tons/mi2/year and Twelvemile least erosive at 5.16 tons/mi2/year (**Figure H-3**).

**Table H-1. LoloSED modeled natural sediment production in the St. Regis watershed**

| Watershed (5th & 6th code HUC #) | Modeled Annual, Natural Sediment Production (tons/year) | Area (sqmi) | Natural Sediment Production Normalized by area (tons/mi2/year) |
|---|---|---|---|
| **St. Regis** | 2399 | 363 | 6.6 |
| **Big Cr (804)** | 273 | 38 | 7.2 |
| **Deer Cr (806)** | 109 | 17 | 6.4 |
| **Little Joe Cr (811)** | 319 | 43 | 7.4 |
| **Lower St. Regis_Mullan (812)** | 219 | 38 | 5.8 |
| **Packer Cr (802)** | 132 | 18 | 7.3 |
| **Savenac Cr (805)** | 109 | 17 | 6.4 |
| **Silver_Timber (803)** | 232 | 30 | 7.7 |
| **Twelvemile Cr (808)** | 310 | 60 | 5.2 |
| **Twin Cr (807)** | 121 | 20 | 6.1 |
| **Twomile Cr (810)** | 117 | 17 | 6.9 |
| **Upper St. Regis (801)** | 306 | 41 | 7.5 |
| **Ward Cr (809)** | 152 | 23 | 6.6 |

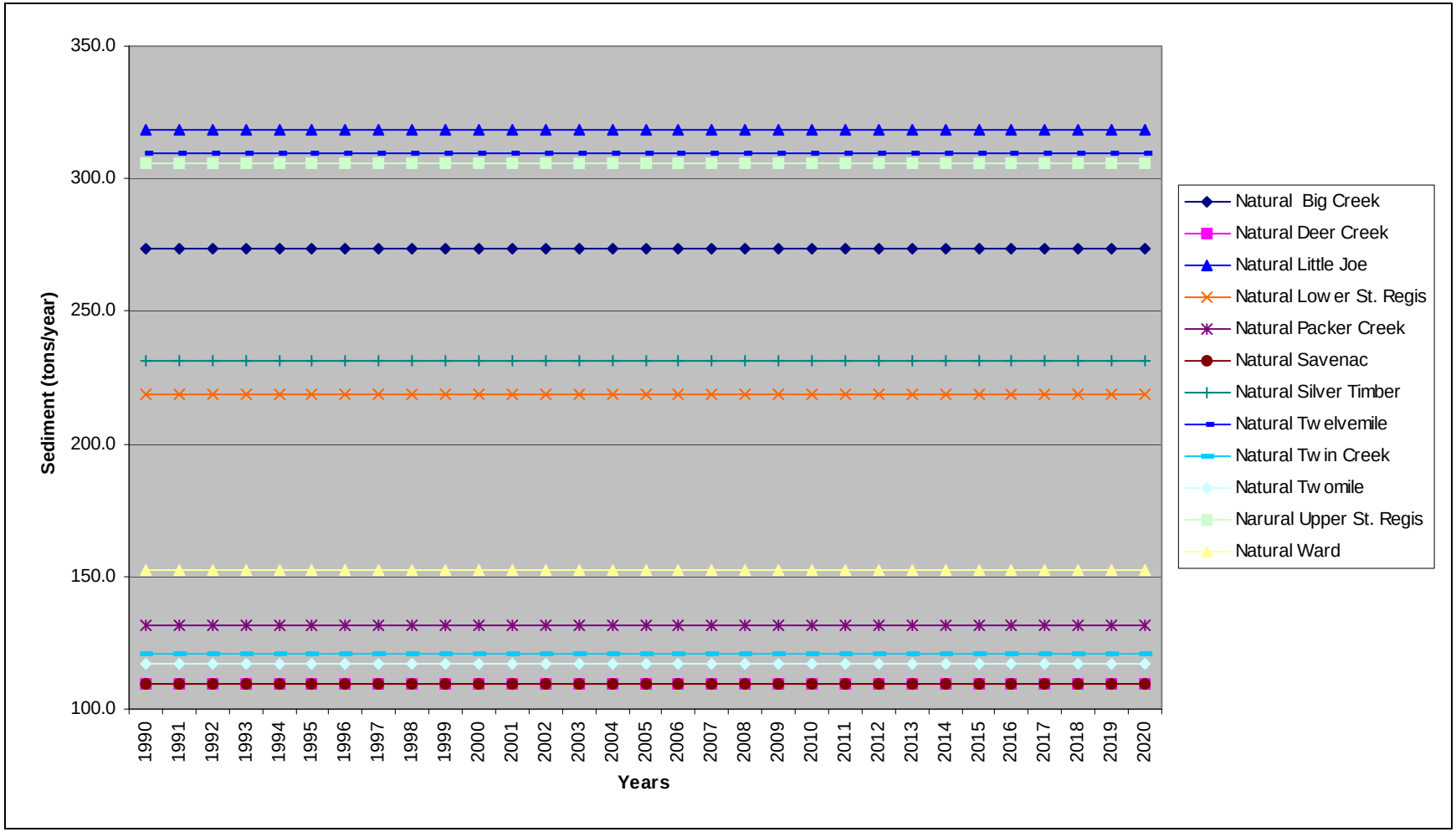


**Figure H-2. LoloSED modeled natural sediment production for St. Regis River tributary watersheds**

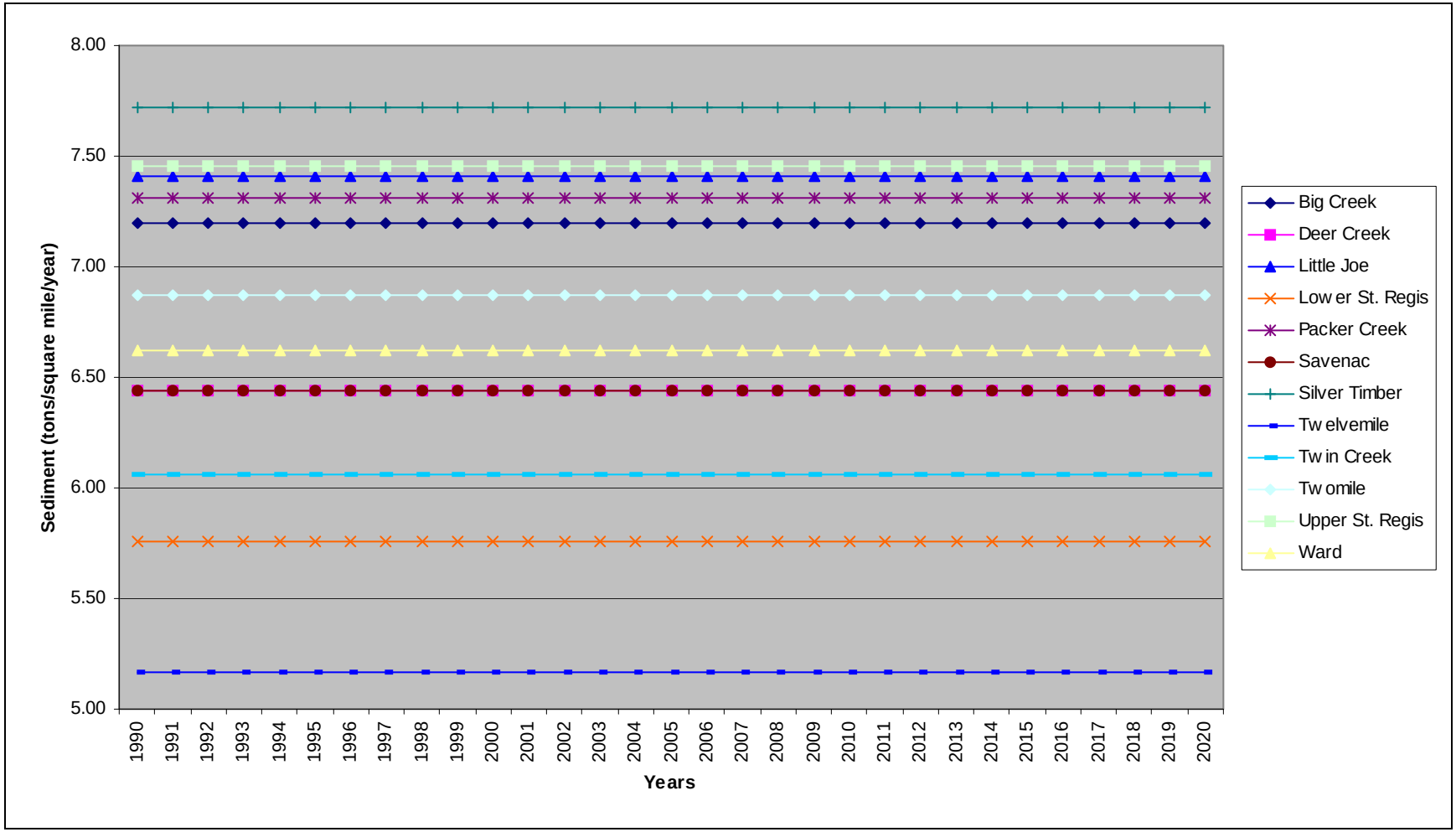


**Figure H-3. LoloSED modeled natural sediment production for St. Regis River tributary watersheds, normalized by drainage area**

The LoloSED model was used to estimate current sediment production increases above natural due to timber harvest activities on record. This information is for National Forest service land only. LoloSED was run in April 2003 to generate these estimates. These estimates are based on the information provided in the TSMRS (timber stand management recording system) for this date, and will not include sediment produced from harvest operations not included in TSMRS.

Based on model results for years 1990 - 2020, sediment production from timber harvest peaked in the early 1990's at approximately 250 tons above natural, and continued to decline until 1997 (**Figure H-4**). In 1998, additional timber harvest activity resulted in a less than 50-ton increase followed by another decline in harvest-related sediment production through the remainder of the analysis period. Note that sediment projected in future years reflects a static condition. Future harvest may increase sediment above the static condition. Also note that this modeling does not include road sediment contributions at stream crossings, does not include any mass wasting that may have occurred from harvest, and assumes overall BMP implementation compliance. The results of this modeling will be used to provide an estimate of natural background sediment loading due to hill slope erosion and bank erosion. Results will also be used for timber harvest upland sediment production source assessment and allocations.

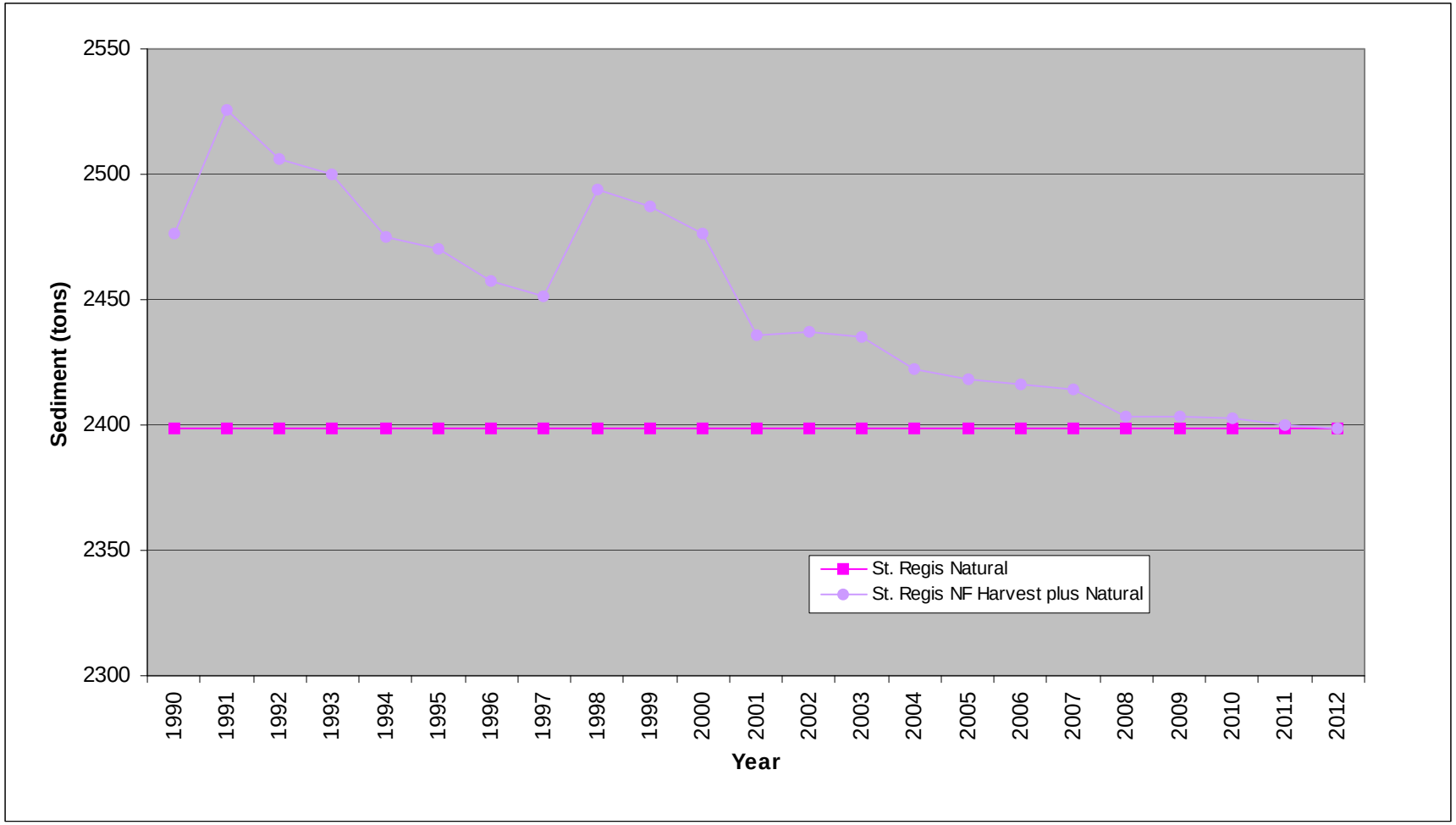


**Figure H-4. LoloSED modeled sediment from National Forest harvest activity compared to natural modeled sediment production for the St. Regis watershed**

## Literature Cited

USDA Forest Service, 1991. WATSED Water & Sediment Yields. USDA Forest Service Region 1 and Montana Cumulative Watershed Effects Cooperative. Missoula, MT.

USDA Forest Service, 1988. Lolo National Forest Land System Inventory. USDA Forest Service, Lolo National Forest. Missoula, MT.